



Imagine a job where you could study space and make discoveries about how the universe is put together. Perhaps uncover the nature of Dark Matter, discover life under the surface of Mars, or detect the first Earth-like planet orbiting a nearby star. Astronomy is the profession that lets you explore the universe, travel the world to present your discoveries to other scientists, and to use amazing technology to study the distant universe. It takes 4 years of college to get a Bachelors Degree in astronomy, and up to 7 years to get a PhD - your ticket to an exciting life-long career in space science. It is hard work, but most of us that have chosen this career cannot imagine any other career that for us is equally worth doing or as exciting. Here is what the American Institute of Physics has to say about the statistics of astronomy:

In astronomy, the PhD class of 2001 included 101 students with 24% women and 27% foreign citizens. Almost three quarters of the combined PhD classes reported accepting postdoctoral appointments. The survey finds that "astronomy PhDs felt very positive about their degree and employment situation." Bachelor's degree production in astronomy has seen a "dramatic rise that began with the class of 2001," according to the report, which finds that "much of this increase coincided with a sharp rise in the number of women receiving astronomy bachelor's degrees." The class of 2001 produced 274 astronomy bachelors, and the class of 2002 produced 325, with 42% women and 6% foreign citizens in the combined classes. Of the respondents in these classes, about half began graduate school, and the other half entered the workforce, with the private sector as the largest employer. While 81% indicated that they would choose an astronomy major again" (<http://www.aip.org/fyi/2005/067.html>)

The top figure is the number of Bachelors and PhDs in astronomy granted each year. The bottom figure is the number of professional members of the US American Astronomical Society in the 'Junior' and 'Full' categories. Also shown is the US population growth (x 1/100,000). The number of research papers (lower graph) shows the number of papers (discoveries!) made by US astronomers each year.

From this graphical information, answer the following questions:

- 1 - According to Figure 1 in the year 2000, about how many PhDs in astronomy were awarded?
- 2 - According to Figure 1, about what percentage of Bachelors degree recipients in astronomy compared to those awarded a PhD in 2004?
- 3 - According to Figure 3 in 2000, about how many papers were published by PhD astronomers in the US?
- 4 - Compare Figure 2 and 3. How many papers per year were published by astronomers in A) 1980? B) 1990? C) 2000? D) About how many papers per year did the average astronomer produce in 2000?
- 5 - According to the text, what two groups have seen the largest changes in terms of Bachelors degree awards?
- 6 - In Figure 2, does population increase during 1985 - 2000 account for the changes in the number of professional astronomers in the USA? What other factors might be involved to stimulate interest in astronomy as a career since 1985?

1 - According to Figure 1 in the year 2000, about how many PhDs in astronomy were awarded?

Answer: Estimates may vary but numbers near 145 are acceptable. The best way to determine this is to use a ruler and draw a line up from '2000' until it meets the 'PhD' curve, then draw a horizontal line to the left-hand vertical axis. Then interpolate between 100 and 150.

2 - According to Figure 1, what percentage of Bachelors degree recipients in astronomy were eventually awarded a PhD in 2004?

Answer: There were about 110 PhDs and 320 Bachelors degrees awarded, so about 1/3 or 33% were awarded the PhD. Some students may have decided not to complete an advanced degree, or to enter another PhD program in a non-astronomy field. The one-in-three does not mean that 2 of 3 Bachelors recipients failed to complete a PhD.

3 - According to Figure 3 in 2000, about how many papers were published by PhD astronomers in the US?

Answer: About 2,900 papers. This only includes publications in the four most popular technical journals including *The Astrophysical Journal* and the *Astronomical Journal*. It does not include publications in other publications such as Conference Proceedings, pre-prints and foreign journals. From all sources, astronomers publish about 15,000 articles every year!

4 - Compare Figure 2 and 3. How many papers per year were published by astronomers in A) 1980? B) 1990? C) 2000? D) About how many papers per year did the average astronomer produce in 2000?

Answer A): About 1600. B) About 2,200 C) About 2,900.

D) There were 7,000 astronomers in 2000 so $2,900/7000 = 0.4$ papers per year, which is about one paper every 3 years.

5 - According to the text, what two groups have seen the largest increase in terms of Bachelors degree awards?

Answer: The percentage of women receiving Bachelors degrees in astronomy has grown from 24% in ca 2001 to 42% in 2002. During the same period, the number of foreign degrees conferred fell from 27% in 2001 to 65% in 2002.

6 - Does population increase during 1985 - 2000 account for the changes in the number of professional astronomers in the USA? What other factors might be involved to stimulate interest in astronomy as a career since 1985?

Answer: The US population increase during this time was 230 million to 280 million which is $100\% \times (280-230)/230 = 21.7\%$. The growth of astronomers was $100\% \times (7000-4200)/4200 = 66.7\%$, so population growth doesn't explain why there are more astronomers in 2000. A major factor that influences the growth of astronomers is exciting new resources like the Hubble Space Telescope, Mars Rovers and exploration, and frequent news stories about 'astronomers discover planets orbiting distant stars'. This motivates students to consider astronomy as a career and eventually causes a surge in new PhDs after 5-8 years.